PATENT ABSTRACTS OF JAPAN

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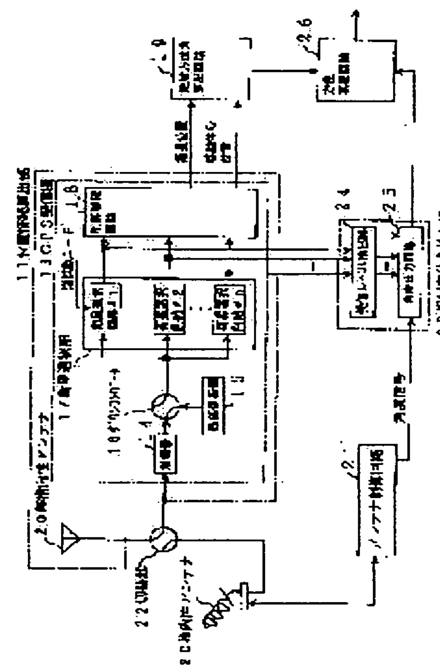
(54) AZIMUTH DETECTING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an azimuth detecting device which receives not the radio wave from a geostationary satellite such as broadcast satellite having limited receiving territory, but the radio wave from a GPS satellite to detect the azimuth, and can detect azimuth in a wide area.
SOLUTION: A GPS signal is received with a non-directional antenna 12, the positional information of a GPS satellite and the positional information of a mobile are computed by a GPS receiver 13, and the absolute azimuth angle of the GPS satellite viewing from the mobile is computed by an absolute azimuth computing circuit 19, based on these positional information. The GPS signal is received with a directional antenna 20, the relative azimuth angle of the GPS satellite against the specific direction specified in the mobile is computed by a relative azimuth angle detecting 23 by intensity of the signal, and based on the relative azimuth angle and the absolute azimuth angle of the GPS satellite, the absolute azimuth angle in the specific direction is computed.



CLAIMS

[Claim(s)]

[Claim 1] A positional information calculation means to compute the positional information of a GPS Satellite, and the positional information of a mobile by receiving a GPS signal, An absolute azimuth calculation means of the above-mentioned GPS Satellite [in / based on the positional information of the above-mentioned GPS Satellite by this positional information calculation means, and the positional information of the above-mentioned mobile / the above-mentioned mobile] to compute an azimuth absolutely, The directional antenna which rotates in the direction of an azimuth to the specific direction specified in the above-mentioned mobile, A relative-azimuth detection means by which this directional antenna receives the electric wave from the above-mentioned GPS Satellite, and the strength of that electric wave detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile, Bearing detection equipment characterized by having a bearing calculation means of the above-mentioned specific direction [in / absolutely based on an azimuth / the above-mentioned mobile] of the above-mentioned relative azimuth and the above-mentioned GPS Satellite to compute an azimuth absolutely.

[Claim 2] The nondirectional antenna which receives a GPS signal, and the GPS receiver which computes the positional information of a GPS Satellite, and the positional information of a mobile from the input signal of this nondirectional antenna, An absolute azimuth calculation means of the above-mentioned GPS Satellite [in / based on the positional information of the above-mentioned GPS Satellite by this GPS receiver, and the positional information of the above-mentioned mobile / the above-mentioned mobile] to compute an azimuth absolutely, The directional antenna which rotates in the direction of an azimuth to the specific direction specified in the above-mentioned mobile, The switcher which changes the input to the above-mentioned GPS receiver from the above-mentioned nondirectional antenna to the above-mentioned directional antenna, A relative-azimuth detection means by which the strength of the input signal inputted into the above-mentioned GPS receiver from the above-mentioned directional antenna through this switcher detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile, Bearing detection equipment characterized by having a bearing calculation means of the above-mentioned specific direction [in / absolutely based on an azimuth / the above-mentioned mobile] of the above-mentioned relative azimuth and the above-mentioned GPS Satellite to compute an azimuth absolutely.

[Claim 3] The above-mentioned relative-azimuth detection means is bearing detection equipment according to claim 2 characterized by detecting the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile by the strength of the input signal by which was inputted into the above-mentioned GPS receiver from the above-mentioned directional antenna through the above-mentioned switcher, and back-diffusion-of-electrons conversion was carried out by the above-mentioned GPS receiver.

[Claim 4] A positional information calculation means to compute the positional information of a GPS Satellite, and the positional information of a mobile by receiving a GPS signal, An absolute azimuth calculation means of the above-mentioned GPS Satellite [in / based on the positional information of the above-mentioned GPS Satellite by this positional information calculation means, and the positional information of the above-mentioned mobile / the above-mentioned mobile] to compute an azimuth absolutely, The antenna which rotated in the direction of an azimuth to the specific direction specified in the above-mentioned mobile, covered some directions of an azimuth of a nondirectional antenna, and reduced gain partially, A relative-azimuth detection means by which this antenna receives the electric wave from the above-mentioned GPS Satellite, and the strength of that electric wave detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile, Bearing detection equipment characterized by having a bearing calculation means of the above-mentioned specific direction in the above-mentioned mobile to compute an

azimuth absolutely, based on the above-mentioned relative azimuth and the above-mentioned absolute azimuth.

[Claim 5] The above-mentioned antenna is bearing detection equipment according to claim 4 characterized by to provide the shield which covers some above-mentioned nondirectional antennas and reduces the gain of the direction of an azimuth partially, and the shield driving means which moves this shield and performs discharge of electric shielding and electric shielding of the above-mentioned nondirectional antenna, and for the above-mentioned shield driving means to cancel electric shielding of the above-mentioned nondirectional antenna, and to receive the above-mentioned GPS signal.

[Claim 6] The above-mentioned antenna is bearing detection equipment according to claim 5 characterized by having a shield rotation means to make the perimeter of the above-mentioned nondirectional antenna rotate the above-mentioned shield.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the bearing detection equipment for detecting the specific directions, such as a travelling direction of a mobile.
[0002]
[Description of the Prior Art] Drawing 12 is the block diagram of the conventional bearing detection equipment shown for example, in the publication-number No. 118155 [six to] official report. In drawing, the broadcasting satellite on the geostationary orbit where 1 transmits a satellite broadcasting electric-wave, BS antenna with which 2 receives the electric wave from a broadcasting satellite 1, the motor by which 3 rotates the BS antenna 2, Motor Driver to which 4 drives a motor 3, the rotary encoder with which 5 detects the angle of rotation of the BS antenna 2, and 6 are antenna angle-of-rotation location detecting elements which detect the angle-of-rotation location of the BS antenna 2 from the output of a rotary encoder 5. The broadcasting satellite tuner which receives the electric wave which received 7 with the BS antenna 2, and 8 are the satellite tracking-control sections which control Motor Driver 4 to carry out the monitor of the strength of an electric wave which received with the broadcasting satellite tuner 7, and to turn [antenna / 2 / BS] to a broadcasting satellite 1. The advance bearing operation part to which 9 calculates advance bearing of a mobile, and 10 are the absolute bearing storage sections which memorize bearing when seeing a broadcasting satellite from a mobile.
[0003] It rotates so that it may turn [antenna / 2 / BS] to a broadcasting satellite 1 by the satellite tracking-control section 8, and the antenna angle-of-rotation location detecting element 6 detects the antenna angle-of-rotation location theta when the BS antenna 2 turns to a broadcasting satellite 1. The advance bearing operation part 9 calculates and asks for the advance bearing alpha using Bearing theta absolutely, when a broadcasting satellite 1 is seen from the mobile absolutely remembered to be the antenna angle-of-rotation location theta detected by the antenna angle-of-rotation location detecting element 6 in the bearing storage section 10. For example, from it being in the range of the seen broadcasting satellite 1 whose bearing is 212 degrees - 226 degrees absolutely, there is the approach of a broadcasting satellite 1 of memorizing bearing absolutely, from the Japan whole region corresponding to the approach of making 220 degrees absolute bearing theta absolutely memorized in the bearing storage section 10, the area where a mobile exists, or a geographic coordinate. About the location where a mobile exists, measuring using GPS (Global Positioning System) is also possible.
[0004]
[Problem(s) to be Solved by the Invention] Since Bearing theta is absolutely memorized and referred to in data format inside equipment, the satellite of the satellite seen with such conventional bearing detection equipment from the point where a mobile exists which follows for bearing detection needs to be a geostationary satellite with which the location of the appearance from the earth is standing it still. When using bearing detection equipment only in Japan, bearing detection will be attained if there are the antenna and receiver which receive the electric wave from the data and the broadcasting satellite of the above absolute bearings theta. However, for every area, since geostationary satellites receivable for every area differ in using bearing detection equipment in every country in the world, while creating the data of Bearing theta absolutely, a characteristic antenna and a characteristic receiver are needed for every satellite, and the compatibility of equipments cannot be maintained, but the technical problem of a geostationary satellite that manufacturability and maintainability worsen occurs.
[0005] This invention was made in order to solve the above technical problems, receives not the electric wave from geostationary satellites, such as a broadcasting satellite with which the receiving field was limited, but the electric wave from a GPS Satellite, detects bearing, and aims at obtaining the bearing detection equipment in which bearing detection is possible in an extensive area.
[0006]

[Means for Solving the Problem] A positional information calculation means to compute the positional information of a GPS Satellite, and the positional information of a mobile by the bearing detection equipment concerning invention of claim 1 receiving a GPS signal, An absolute azimuth calculation means of the above-mentioned GPS Satellite [in / based on the positional information of the above-mentioned GPS Satellite by this positional information calculation means, and the positional information of the above-mentioned mobile / the above-mentioned mobile] to compute an azimuth absolutely, The directional antenna which rotates in the direction of an azimuth to the specific direction specified in the above-mentioned mobile, A relative-azimuth detection means by which this directional antenna receives the electric wave from the above-mentioned GPS Satellite, and the strength of that electric wave detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile, It has a bearing calculation means of the above-mentioned specific direction [in / absolutely based on an azimuth / the above-mentioned mobile] of the above-mentioned relative azimuth and the above-mentioned GPS Satellite to compute an azimuth absolutely.
[0007] The nondirectional antenna with which the bearing detection equipment concerning invention of claim 2 receives a GPS signal, The GPS receiver which computes the positional information of a GPS Satellite, and the positional information of a mobile from the input signal of this nondirectional antenna, An absolute azimuth calculation means of the above-mentioned GPS Satellite [in / based on the positional information of the above-mentioned GPS Satellite by this GPS receiver, and the positional information of the above-mentioned mobile / the above-mentioned mobile] to compute an azimuth absolutely, The directional antenna which rotates in the direction of an azimuth to the specific direction specified in the above-mentioned mobile, The switcher which changes the input to the above-mentioned GPS receiver from the above-mentioned nondirectional antenna to the above-mentioned directional antenna, A relative-azimuth detection means by which the strength of the input signal inputted into the above-mentioned GPS receiver from the above-mentioned directional antenna through this switcher detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile, It has a bearing calculation means of the above-mentioned specific direction [in / absolutely based on an azimuth / the above-mentioned mobile] of the above-mentioned relative azimuth and the above-mentioned GPS Satellite to compute an azimuth absolutely.
[0008] In the bearing detection equipment which the bearing detection equipment concerning invention of claim 3 requires for invention of claim 2, the above-mentioned relative-azimuth detection means detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile by the strength of the input signal by which was inputted into the above-mentioned GPS receiver from the above-mentioned directional antenna through the above-mentioned switcher, and back-diffusion-of-electrons conversion was carried out by the above-mentioned GPS receiver.
[0009] A positional information calculation means to compute the positional information of a GPS Satellite, and the positional information of a mobile by the bearing detection equipment concerning invention of claim 4 receiving a GPS signal, An absolute azimuth calculation means of the above-mentioned GPS Satellite [in / based on the positional information of the above-mentioned GPS Satellite by this positional information calculation means, and the positional information of the above-mentioned mobile / the above-mentioned mobile] to compute an azimuth absolutely, The antenna which rotated in the direction of an azimuth to the specific direction specified in the above-mentioned mobile, covered some directions of an azimuth of a nondirectional antenna, and reduced gain partially, A relative-azimuth detection means by which this antenna receives the electric wave from the above-mentioned GPS Satellite, and the strength of that electric wave detects the relative azimuth to the above-mentioned specific direction of the above-mentioned GPS Satellite in the above-mentioned mobile, Based on the above-mentioned relative azimuth and the above-mentioned absolute azimuth, it has a bearing calculation means of the above-mentioned specific direction in the above-mentioned mobile to compute an azimuth absolutely.

[0010] The shield which covers some above-mentioned nondirectional antennas and reduces the gain of the direction of an azimuth partially, and the shield driving means which moves this shield and perform in discharge of electric shielding and electric shielding of the above-mentioned nondirectional antenna provide, electric shielding of the above-mentioned nondirectional antenna cancels by the above-mentioned shield driving means, and the above-mentioned antenna receives the above-mentioned GPS signal in the bearing detection equipment which the bearing detection equipment concerning invention of claim 5 requires for invention of claim 4.
[0011] The above-mentioned antenna is equipped with a shield rotation means to make the perimeter of the above-mentioned nondirectional antenna rotate the above-mentioned shield, in the bearing detection equipment which the bearing detection equipment concerning invention of claim 6 requires for invention of claim 5.
[0012]
[Embodiment of the Invention] gestalt 1. of operation -- the bearing detection equipment concerning the gestalt 1 of implementation of this invention is explained based on drawing 1 - drawing 4 . Drawing 1 is the block diagram of the bearing detection equipment concerning the gestalt 1 of implementation of this invention. In drawing 1 , 11 is the positional information calculation section which computes the positional information of a GPS Satellite, and the positional information of a mobile by receiving a GPS signal. The nondirectional antenna with which 12 receives a GPS signal, and 13 are GPS receivers. The local oscillator which generates a reference signal for the amplifier with which 14 amplifies a GPS signal, and 15 to modulate a GPS signal to the signal of an intermediate frequency band, and 16 are down converters. 17 is the satellite selection section which carries out back-diffusion-of-electrons conversion of the GPS signal received according to the GPS Satellite. At GPS receiver 13, in two-dimensional positioning, in the GPS signal from three sets of GPS Satellites, and three-dimension positioning, the positional information of a mobile is computed based on the GPS signal from four sets of GPS Satellites, and in order to receive these signals to coincidence, the satellite selection section 17 consists of at least three or more satellite selection circuitries. 18 is a control decode circuit which decodes the positional information and time information of a GPS Satellite from the GPS signal which the satellite selection section 17 outputted, and computes the positional information of a mobile by above-mentioned two-dimensional positioning or above-mentioned three-dimension positioning while sending out a back-diffusion-of-electrons code to the satellite selection section 17. 19 is an absolute azimuth calculation circuit of the GPS Satellite seen from the mobile by the positional information of the GPS Satellite from the control decode circuit 18, and the positional information of a mobile which computes bearing absolutely. The directional antenna with which 20 receives the electric wave from a GPS Satellite, and 21 are antenna control circuits which rotate a directional antenna 20 in the direction of an azimuth to the specific direction (for example, travelling direction) specified in the mobile, and output the include angle of a directional antenna 20. 22 is a switcher which changes the output of a nondirectional antenna 12 and a directional antenna 20, and is inputted into GPS receiver 13. 23 is a relative-azimuth detecting element which detects the relative azimuth of the above-mentioned specific direction and a GPS Satellite based on the GPS signal from the directional antenna 21 by which back-diffusion-of-electrons conversion was carried out in the satellite selection section 18 through the include-angle signal and switcher 22 from the antenna control circuit 21. The receiving level detector which carries out the monitor of the strength of the GPS signal from the directional antenna 21 with which back-diffusion-of-electrons conversion of 24 was carried out in the satellite selection section 17 through the switcher 22, and 25 are include-angle output circuits which hold and output the include-angle signal which an antenna control circuit outputs based on the output of the receiving level detector 24. 26 is a bearing calculation circuit of the relative azimuth detected by the relative-azimuth detecting element 23, and the absolute azimuth computed absolutely in the azimuth calculation circuit 19 to the above-mentioned specific direction which computes an azimuth absolutely.
[0013] On an orbit, the GPS Satellite of 21 (+3 spare) radical is going around, and it can position by receiving the GPS signal from a GPS Satellite in the whole world. The GPS signal of the GPS Satellite which looks at a nondirectional antenna 12 from a mobile, and becomes visible is

received, and the received GPS signal is inputted into GPS receiver 13. In GPS receiver 13, in performing three-dimension positioning, for example, the signal from four sets of GPS Satellites is required as mentioned above, and it receives, without the satellite selection section's 17 restoring to the received GPS signal, and interfering the GPS signal from four sets of GPS Satellites based on four back-diffusion-of-electrons codes from the control decode circuit 18. The control decode circuit 18 decodes the positional information and time information of a GPS Satellite from the received GPS signal, and computes the positional information of a mobile by two-dimensional positioning or three-dimension positioning. The azimuth calculation circuit 19 computes absolutely the absolute azimuth of the GPS Satellite seen from the mobile by the positional information of the GPS Satellite decoded in the control decode circuit 18, and the positional information of a mobile. Drawing 2 shows the physical relationship of the mobile (point P) in the rectangular three-dimension system of coordinates based on the earths (point O), and a GPS Satellite (point Q). It is expressed with the angle NPR which shows it to drawing 3 when the point which projected Point Q on NE flat surface (N is north and E is east mind) of the GPS Satellite seen from the mobile at which Azimuth theta touches a global aspect at Point P absolutely is set to R.

[0014] In drawing 3 , Direction PS is the specific direction specified in the mobile, for example, is a travelling direction of a mobile etc. A directional antenna 20 rotates in the direction of an azimuth to Direction PS, and the antenna control circuit 21 outputs the angle of rotation over the specific direction to the include-angle output circuit 25. The GPS signal from the GPS Satellite which a directional antenna 20 receives is inputted into GPS receiver 13 through a switcher 22, and back-diffusion-of-electrons conversion is carried out in the satellite selection section 17, and it is inputted into the receiving level detector 24. As mentioned above, in performing three-dimension positioning, for example, in order to receive without interfering the GPS signal from four sets of GPS Satellites, the diffusion modulation of the GPS signal from each GPS Satellite is carried out below at the noise level. Therefore, in order to carry out the monitor of the strength of a GPS signal, it is desirable to use what carried out back-diffusion-of-electrons conversion of the GPS signal. As shown in drawing 4 , the receiving level detector 24 detects the level of the GPS signal which changes with rotation of a directional antenna 20, and outputs it to an include-angle output circuit. The include-angle output circuit 25 is angle-of-rotation thetaR of the directional antenna 20 with which receiving level serves as a peak as shown in drawing 4 . It holds and outputs to the bearing calculation circuit 26. relative-azimuth thetaR of a GPS Satellite to the specific direction of the mobile of the GPS Satellite seen from the mobile absolutely computed in the azimuth calculation circuit 19 as the bearing calculation circuit 26 was shown in drawing 3 absolutely detected in Azimuth theta and the include-angle output circuit 25 from -- the specific direction of a mobile -- Azimuth alpha (=theta-thetaR) is computed absolutely. In addition, a directional antenna 20 can receive the GPS signal from the GPS Satellite which moves in a circumference orbit top while changing an elevation angle, without driving an antenna in the direction of an elevation angle, if it is made to have a radiation pattern large in the direction of an elevation angle, and a radiation pattern narrow in the direction of an azimuth.

[0015] In the gestalt 1 of the gestalt 2. above-mentioned implementation of operation The azimuth calculation circuit 19 computes an azimuth absolutely about one GPS Satellite. Although the relative azimuth to the specific direction of a mobile was detected about one GPS Satellite in the relative-azimuth detecting element 23 by the strength of a GPS signal which receives with a directional antenna 20 and the absolute azimuth of the specific direction of a mobile was computed in the bearing calculation circuit 26 As shown in drawing 5 , the relative azimuth [as opposed to / compute an azimuth absolutely, and a directional antenna 20 receives the GPS signal from these GPS Satellites, and / the specific direction of a mobile] of each GPS Satellite of two or more sets of GPS Satellites may be detected. In drawing 5 , R1, R2, and R3 are the points which projected the location of three sets on NE flat surface among four sets of the GPS Satellites received for example, in three-dimension positioning, and an include angle thetaR1, thetaR2, and thetaR3 are the absolute azimuths of each GPS Satellite absolutely computed in the azimuth calculation circuit 19. By the satellite selection circuitry of the satellite selection

section 17, back-diffusion-of-electrons conversion is carried out, and the monitor of the GPS signal which rotated the directional antenna 20 and was received is carried out like drawing 6 in the receiving level detector 24. In drawing 6 , it shall be the angle of rotation of the directional antenna 20 with which the level of the GPS signal from thetaR1+epsilonR1, thetaR2+epsilonR2, thetaR3+epsilonR3, and a **** GPS Satellite serves as a peak, and the error of epsilonR1, epsilonR2, and epsilonR3 shall have arisen with the precision and resolution of a receiving level detector, respectively. From drawing 5 , an error epsilonR1, epsilonR2, and epsilonR3 are [0016].
[Equation 1]
$\varepsilon R1 = 360 - \alpha + \Theta R1 - \theta R1$

[0017]
[Equation 2]
$\varepsilon R2 = 360 - \alpha + \Theta R2 - \theta R2$

[0018]
[Equation 3]
$\varepsilon R3 = 360 - \alpha + \Theta R3 - \theta R3$

[0019] It comes out, and it is and the bearing calculation circuit 26 computes the absolute azimuth alpha of the specific direction of a mobile where the square sum of an error epsilonR1, epsilonR2, and epsilonR3 serves as min by the degree type.
[0020]
[Equation 4]
$\alpha = (C1 + C2 + C3) / 3$

[0021] Here, C1, C2, and C3 are given by the degree type.
[0022]
[Equation 5]
$C1 = 360 + \Theta R1 - \theta R1$

[0023]
[Equation 6]
$C2 = 360 + \Theta R2 - \theta R2$

[0024]
[Equation 7]
$C3 = 360 + \Theta R3 - \theta R3$

[0025] What is necessary is just to set to alpha anew the value which lengthened 360deg(s) from alpha, when alpha is set to 360 or more degs. If the number of the GPS Satellites used for bearing detection as mentioned above increases, the precision of bearing detection will become good.
[0026] In the gestalt 1 of the gestalt 3. above-mentioned implementation of operation, although the angle of rotation of the directional antenna 20 with which receiving level serves as a peak was detected as a directional antenna 20 was rotated and it was shown in drawing 4 , the antenna which covered some directions of an azimuth of a nondirectional antenna as shown in drawing 7 with the shield may be used. In drawing 7 , 27 is a nondirectional antenna and 28 is a shield. Since the nondirectional antenna 27 is having a part of direction of an azimuth covered by the shield 28, when this antenna is rotated in the direction of bearing and there is a shield 28 in the direction of a GPS Satellite as the GPS signal from a GPS Satellite is shown in drawing 8 , receiving level falls. The include-angle output circuit 25 is angle-of-rotation thetaR from [where receiving level serves as the minimum / of a mobile] specification. It detects and outputs to the bearing calculation circuit 26. The bearing calculation circuit 26 computes the absolute azimuth alpha of the specific direction of a mobile (=theta-thetaR) like the gestalt 1 of the above-mentioned implementation.
[0027] Although the switcher 22 which changes the output of a nondirectional antenna 12,

directional antennas 20, and these antennas constituted the preceding paragraph of GPS receiver 13 from the gestalt 1 of the gestalt 4. above-mentioned implementation of operation, some directions of an azimuth of a nondirectional antenna as shown in drawing 9 may be covered with a shield, and the antenna which can rotate a shield to the circumference of a forward-and-backward inclination shaft may be used. In drawing 9 , 29 is a rotation base which has the hinge which can rotate a shield 28 to the circumference of a forward-and-backward inclination shaft, and rotates to the circumference of azimuth axes. Although a nondirectional antenna 27 may be rotated with a shield 28 and the rotation base 29, a nondirectional antenna 27 may be fixed to rotation of the circumference of the azimuth axes of the rotation base 29 and only a shield 28 and the rotation base 29 may be rotated, latter one of the inertia for moving part is small, and immobilization of RF cable from a nondirectional antenna 27 is easy. In addition, a shield 28 is rotated to the circumference of a forward-and-backward inclination shaft in the above-mentioned hinge using a motor etc. Drawing 10 is the block diagram of the bearing detection equipment concerning the gestalt 4 of implementation of this invention. In drawing 10 R> 0, 30 is a shield drive circuit which generates the driving signal which rotates a shield 28 to the circumference of a forward-and-backward inclination shaft, and 31 is a shield rotation circuit which generates the signal which rotates a shield 28 and the rotation base 29 to the circumference of azimuth axes.

[0028] After rotating in the direction in which the elevation angle which shows a shield 28 to drawing 9 becomes small and canceling electric shielding of a nondirectional antenna 27, a GPS signal is received and the positional information of a GPS Satellite and the positional information of a mobile are computed in GPS receiver 13. If a shield 28 and the rotation base 29 are rotated after the elevation angle which shows a shield 28 to drawing 9 rotates in the direction which becomes large and covers a part of azimuth of a nondirectional antenna 27, as shown in drawing 8 , when a shield 27 is in bearing of a GPS Satellite, receiving level will fall, and the relative azimuth theta of a GPS Satellite to the specific direction of a mobile will be detected.

[0029] Although the shield 28 was rotated to the circumference of a forward-and-backward inclination shaft and electric shielding of a nondirectional antenna 27 was canceled with the gestalt 4.of the gestalt 5. above-mentioned implementation of operation, as shown in drawing 11 , it is good for the circumference of the horizontal axis of the rotation base 29 also as a configuration turning around a shield 28. If a shield 28 is rotated in the direction in which the elevation angle shown in drawing 9 becomes small, since the point of a shield 28 will move in the direction which separates from azimuth axes, the space which equipment occupies becomes large, but if a shield 28 is rotated to the circumference of a horizontal axis as shown in drawing 11 , since the point of a shield 28 moves in the place near azimuth axes compared with the case of drawing 9 , the occupancy space of equipment will become small.

[0030]

[Effect of the Invention] According to invention of claim 1, the absolute azimuth of a GPS Satellite is computed from the positional information of the GPS Satellite which receives and computes a GPS signal, and the positional information of a mobile. Since bearing of the specific direction of a mobile is detected based on the relative azimuth of a GPS Satellite to the specific direction of the mobile detected by rotating this absolute azimuth and directional antenna and detecting the strength of a GPS signal Bearing detection can be carried out in an extensive area, without receiving the electric wave from geostationary satellites, such as a broadcasting satellite with which the receiving range was restricted, and carrying out bearing detection.

[0031] Since according to invention of claim 2 the output of the directional antenna which receives a GPS signal is changed by the switcher in order to detect the output of the nondirectional antenna which receives a GPS signal in order to compute the positional information of a GPS Satellite, and the positional information of a mobile, and the relative azimuth of a GPS Satellite to the specific direction of a mobile, the GPS receiver to each antenna is sharable.

[0032] Since according to invention of claim 3 the monitor of receiving level is performed after carrying out back-diffusion-of-electrons conversion of the GPS signal received with the directional antenna, a signal component can be detected without being buried in a noise

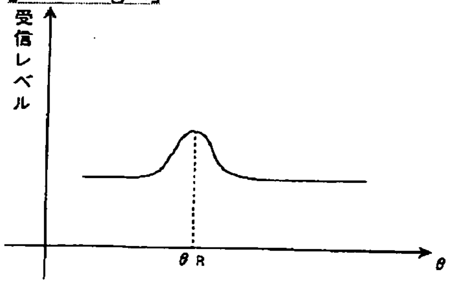
component.
[0033] Since the GPS signal for relative-azimuth detection of the GPS Satellite to the specific direction of a mobile is acquired with the antenna which covered some directions of an azimuth of a nondirectional antenna, and reduced gain partially according to invention of claim 4, in order to compute the hardware of the nondirectional antenna of this antenna, the positional information of a GPS Satellite, and the positional information of a mobile, the hardware of a nondirectional antenna which receives a GPS signal can be communalized.
[0034] Since the GPS signal for computing the positional information of a GPS Satellite and the positional information of a mobile by acquiring the GPS signal for relative-azimuth detection of the GPS Satellite to the specific direction of a mobile with the antenna which covered some directions of an azimuth of a nondirectional antenna, and reduced gain partially, and canceling the above-mentioned electric shielding is received according to invention of claim 5, an antenna can be set to one.
[0035] Since according to invention of claim 6 it fixes and a nondirectional antenna rotates a shield, inertia for moving part can be made small.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the bearing detection equipment concerning the gestalt 1 of implementation of this invention.
[Drawing 2] The mimetic diagram showing the physical relationship of the mobile concerning the gestalt 1 of implementation of this invention, and a GPS Satellite.
[Drawing 3] The specific direction of the mobile concerning the gestalt 1 of implementation of this invention, and the mimetic diagram of a GPS Satellite showing the relation of the direction of bearing absolutely.
[Drawing 4] The property Fig. showing the output of the receiving level detector when rotating the directional antenna concerning the gestalt 1 of implementation of this invention.
[Drawing 5] The specific direction of the mobile concerning the gestalt 2 of implementation of this invention, and the mimetic diagram of three sets of GPS Satellites showing the relation of the direction of bearing absolutely.
[Drawing 6] The property Fig. showing the output of the receiving level detector when rotating the directional antenna concerning the gestalt 2 of implementation of this invention, and receiving the GPS signal of three sets of GPS Satellites.
[Drawing 7] The perspective view showing the configuration of the antenna which covered some directions of an azimuth of the nondirectional antenna concerning the gestalt 3 of implementation of this invention.
[Drawing 8] The property Fig. showing the output of the receiving level detector when rotating the antenna which covered some directions of an azimuth of the nondirectional antenna concerning the gestalt 3 of implementation of this invention.
[Drawing 9] The block diagram of the antenna which carries out electric shielding and electric shielding discharge in some directions of an azimuth of the nondirectional antenna concerning the gestalt 4 of implementation of this invention.
[Drawing 10] The block diagram of the bearing detection equipment concerning the gestalt 4 of implementation of this invention.
[Drawing 11] The block diagram of the antenna which rotates a shield and carries out electric shielding discharge with the electric shielding and the horizontal axis of some directions of an azimuth of a nondirectional antenna concerning the gestalt 5 of implementation of this invention.
[Drawing 12] The block diagram of conventional bearing detection equipment.
[Description of Notations]
11 Location Calculation Section
12 Nondirectional Antenna
13 GPS Receiver
19 It is Azimuth Calculation Circuit Absolutely.
20 Directional Antenna
22 Switcher
23 Relative-Azimuth Detecting Element
26 Bearing Calculation Circuit
27 Nondirectional Antenna
28 Shield
30 Shield Drive Circuit
31 Shield Rotation Circuit

DRAWINGS

[Drawing 4]



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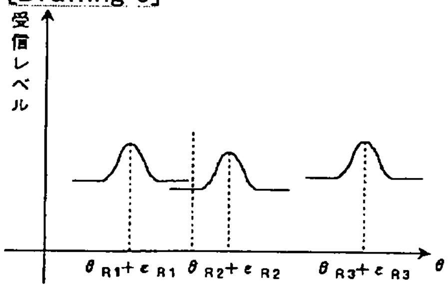
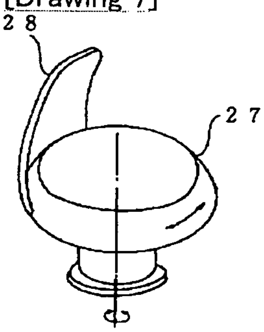
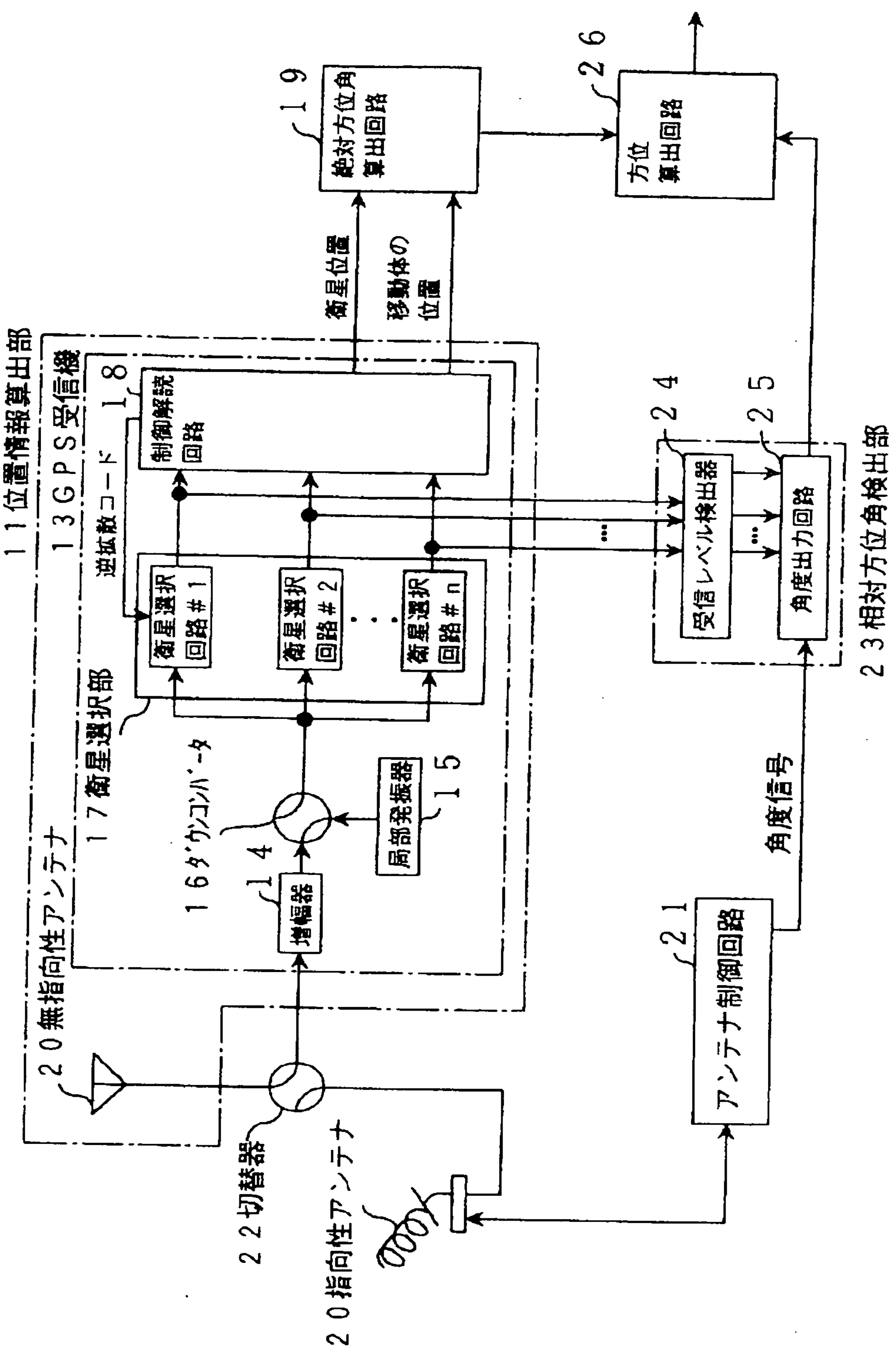
[Drawing 6]



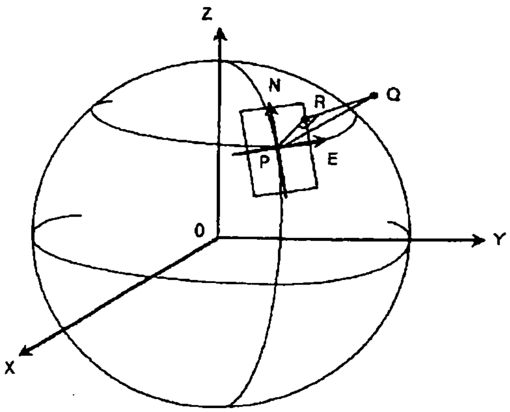
[Drawing 7]



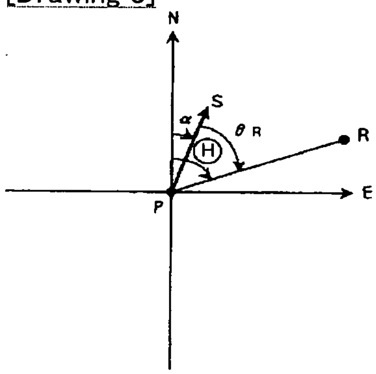
[Drawing 1]


11位置情報算出部
13GPS受信機
17衛星選択部
16ダウンコンバータ
14
増幅器
局部発振器
15
衛星選択回路#1
衛星選択回路#2
衛星選択回路#n
逆拡散コード
18
制御解読回路
衛星位置
移動体の位置
19
絶対方位角算出回路
26
方位算出回路
24
受信レベル検出器
25
角度出力回路
23相対方位角検出部
角度信号
21
アンテナ制御回路
20無指向性アンテナ
22切替器
20指向性アンテナ

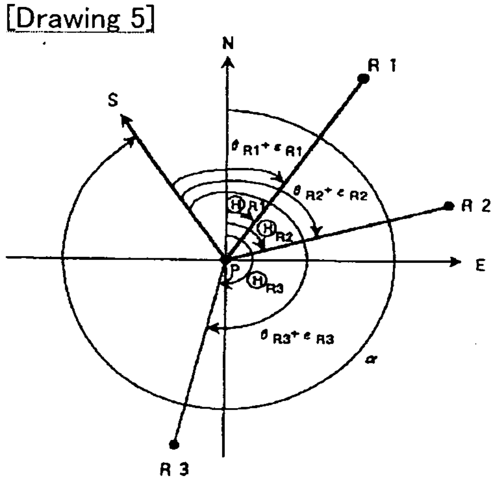
[Drawing 2]



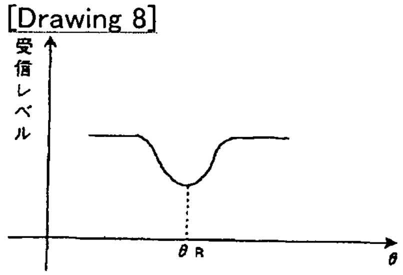
[Drawing 3]



[Drawing 5]



[Drawing 8]



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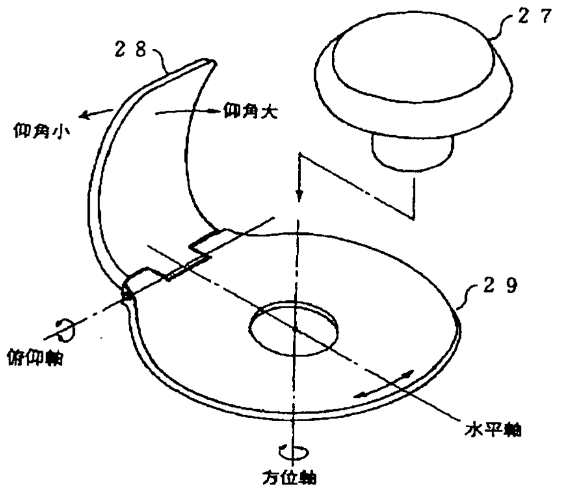
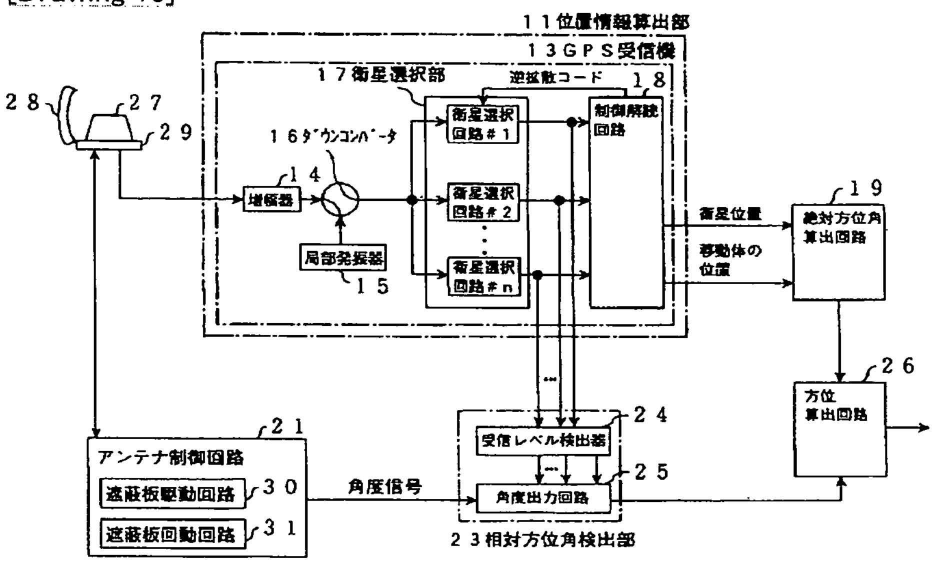
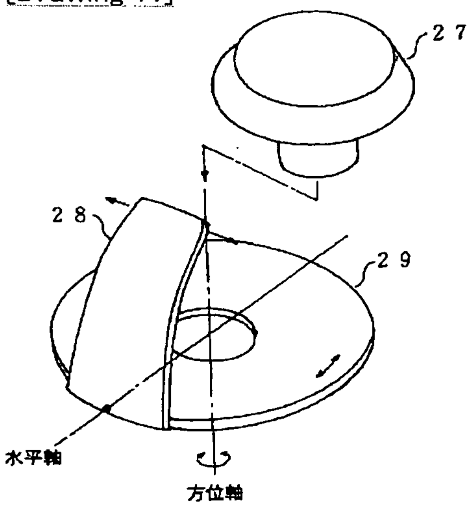


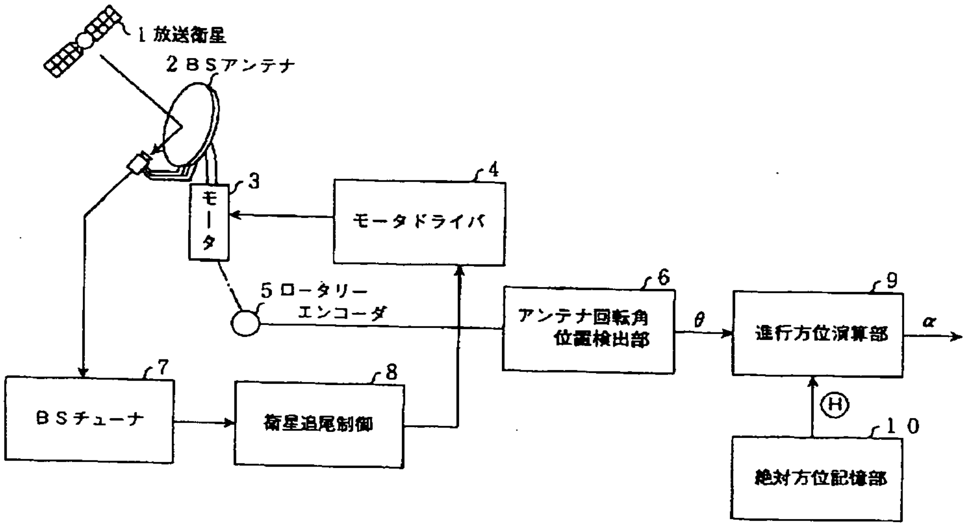
[Drawing 10]



[Drawing 11]



[Drawing 12]


1 放送衛星
2 BSアンテナ
3
モータ
4
モータドライバ
5 ロータリーエンコーダ
6
アンテナ回転角位置検出部
θ
9
進行方位演算部
α
7
BSチューナ
8
衛星追尾制御
H
10
絶対方位記憶部